Electronic Version
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Claims

[c1] 1. A method for controlling a vehicle using a nonlinear error-based control, the method comprising:
determining a current value of a first vehicle parameter;
determining a first error, the first error being a difference between a first target value of the first vehicle parameter and the current value of the first vehicle parameter; and
determining a first vehicle request, the first vehicle request being a nonlinear function of the first error.

[c2] 2. The method of claim 1, further comprising:
determining a second vehicle request; and
arbitrating the first and second vehicle requests, thereby determining a first arbitrated vehicle request.

[c3] 3. The method of claim 2, further comprising:
determining a second error, the second error being a difference between a second target value of the first vehicle parameter and the current value of the first vehicle parameter; and
determining a third vehicle request, the third vehicle request being a nonlinear function of the second error.

[c4] 4. The method of claim 3, further comprising:
arbitrating the first arbitrated vehicle request and the third vehicle request, thereby determining a fourth vehicle request.

[c5] 5. The method of claim 4, further comprising:
determining a current value of a second vehicle parameter;
determining a third error, the third error being a difference between the fourth vehicle request and the current value of the second vehicle parameter; and
applying an integrator to the third error, the integrator being the only integrator applied in the method.

[c6] 6. The method of claim 5, further comprising applying a first transfer function to the second vehicle parameter and the fourth vehicle request, thereby deriving a fifth vehicle request, the first transfer function including the integrator.

[c7] 7. The method of claim 6, the vehicle including a speed control system, wherein the first vehicle parameter is a vehicle speed, the first target value of the first vehicle parameter is a set point of the speed control system, the first error is a first speed error, and the first vehicle request is a speed control system desired acceleration.

[c8] 8. The method of claim 7, wherein the second vehicle request is a driver desired acceleration, and arbitrating the first and second vehicle requests includes determining the larger of the speed control system desired acceleration and the driver desired acceleration.

[c9] 9. The method of claim 8, wherein the second target value of the first vehicle parameter includes a predetermined vehicle speed limit, and the third vehicle request includes a vehicle speed limit desired acceleration.

[c10] 10. The method of claim 9, wherein arbitrating the first arbitrated vehicle request and the third vehicle request includes determining the lesser of the first arbitrated vehicle request and the vehicle speed limit desired acceleration.

[c11] 11. The method of claim 10, wherein the fourth vehicle request includes a first vehicle acceleration request, and the fifth vehicle request includes a second vehicle acceleration request.

[c12] 12. The method of claim 11, wherein the first transfer function further includes a feedforward action and a proportional action.

[c13] 13. The method of claim 12, further comprising applying a second transfer function to the driver desired accelera-

tion, the second transfer function being configured to cancel the integration action in the first transfer function when the first vehicle acceleration request is the driver desired acceleration.

[c14] 14. A method for controlling a vehicle using nonlinear error-based control, the method comprising:
determining a current value of a vehicle parameter;
determining a first error, the first error being a difference between a target value of the parameter and the parameter current value; and
applying a first gain to the first error, thereby producing a first vehicle request, the first gain being a function of the absolute value of the first error.

[c15] 15. The method of claim 14, wherein the first gain is defined by the following:
$Kcc = K_p + \beta|v\_cc - v|$, where Kcc is the first gain, K_p is a first constant, β is a second constant, v_cc is a target speed, and v is a determined current speed.

[c16] 16. The method of claim 14, wherein the first gain is defined the following:
$Kcc = \max(K_p, \beta|v\_cc - v|)$, where max is the maximum of K_p and $|v\_cc - v|$, Kcc is the first gain, K_p is a first constant, β is a second constant, v_cc is a target speed, and v is a determined current speed.

[c17] 17. The method of claim 14, the vehicle including a speed control system, wherein the parameter is a vehicle speed, the target value of the parameter is a set point of the speed control system, the first error is a first speed error, and the first vehicle request is a speed control system desired acceleration.

[c18] 18. The method of claim 17, the method further comprising:

determining a second speed error, the second speed error being a difference between a predetermined vehicle speed limit and the vehicle speed;

applying a second gain to the second speed error, thereby producing a vehicle speed limit desired acceleration, the second gain being a function of the absolute value of the second error;

determining a driver desired acceleration;

determining a first arbitrated desired acceleration, the first arbitrated desired acceleration being the larger of the speed control system desired acceleration and the driver desired acceleration; and

determining a first vehicle acceleration request, the first vehicle acceleration request being the lesser of the vehicle speed limit desired acceleration and the first arbitrated desired acceleration.

[c19] 19. The method of claim 18, further comprising:
determining a current value of the vehicle acceleration;
determining an acceleration error, the acceleration error being a difference between the first vehicle acceleration request and the vehicle acceleration current value; and
applying a first transfer function to the acceleration error, thereby deriving a second vehicle acceleration request.

[c20] 20. The method of claim 19, wherein the first transfer function includes a feedforward action, an integration action and a proportional action.

[c21] 21. The method of claim 20, further comprising applying a second transfer function to the driver desired acceleration, the second transfer function being configured to cancel the integration action in the first transfer function when the first vehicle acceleration request is the driver desired acceleration.

[c22] 22. A vehicle, comprising:
at least one torque producing device operable to propel the vehicle;
at least one sensor configured to measure a vehicle parameter and to output signals related to the measured parameter; and
a controller configured to receive signals from the at

least one sensor, determine a first error, and determine a vehicle request, thereby facilitating control of the at least one torque producing device, the first error being a difference between a target value of the vehicle parameter and a measured value of the vehicle parameter, the vehicle request being a nonlinear function of the first error.

[c23] 23. The vehicle of claim 22, wherein the vehicle request is used to determine an amount of torque requested from the at least one torque producing device.

[c24] 24. The vehicle of claim 22, wherein the at least one torque producing device includes an engine, the vehicle further comprising a throttle operable to control the flow of air to the engine, and wherein the vehicle request is used to determine the throttle angle.

[c25] 25. The vehicle of claim 22, wherein the at least one torque producing device includes an electric motor, the vehicle further comprising a fuel cell operable to provide electricity to the motor, and wherein the vehicle request is used to determine the amount of electricity provided to the motor.

[c26] 26. The vehicle of claim 22, wherein the at least one torque producing device includes a diesel engine, and the vehicle request is used to determine a fueling rate of

the diesel engine.